MECHANICS.

69. Proposed by B. F. FINKEL, A. M.,M. Sc., Professor of Mathematics and Physics, Drury College, Springfield, Mo.

A rough sphere of radius a and radius of gyration K, capable of rotating about its center, is initially at rest ; another sphere of $1/n$ the mass and of radius b, and radius of gyration k, is placed gently on it, having initially an angular velocity ω about the common normal which makes an acute angle α with the vertical drawn upwards. Prove that the second sphere will not roll off provided

$$\omega^2 > \frac{2\mu(a+b)g}{(3\mu+1)b^2}[(3\mu+1)^2-4\mu^2\cos^2\alpha]\sec\alpha, \text{ where } \mu=a^2/nK^2+b^2/k^2.$$

[From *Routh's Rigid Dynamics.*]

70. Proposed by CHAS. E. MEYERS, Canton, Ohio.

A homogeneous sphere, radius r, having an angular velocity ω, gradually contracts by cooling. What will be the angular velocity at the instant the radius becomes $\frac{1}{2}r$?

*** Solutions of these problems should be sent to B. F. Finkel, not later than August 10.

DIOPHANTINE ANALYSIS.

68. Proposed by M. A. GRUBER, A. M., War Department, Washington, D. C.

Find a *general* value for p in the expression $4p+1$=the sum of two squares.

69. Proposed by JOSIAH H. DRUMMOND, LL. D., Counselor at Law, Portland, Me.

Two right angled triangles have the same base which is a mean proportional between the two perpendiculars: find a general solution, that will give integral values for all the sides of both triangles.

70. Proposed by PROF. CHARLES CARROLL CROSS, Libertytown, Md.

Give methods for decomposing numbers into squares, cubes, or biquadrates and show that 61×200^3 is the sum of ten cube numbers and that 844933 is the sum of eleven biquadrates in thirteen different ways. [From *The Mathematical Magazine*, Vol. II, No. 10.]

*** Solutions of these problems should be sent to J. M. Colaw, not later than August 10.

AVERAGE AND PROBABILITY.

65. Proposed by J. SCHEFFER, A. M., Hagerstown, Md.

What is the average rate of the sun's motion in declination from the equator to the solstices ?

66. Proposed by REV. W. ALLEN WHITWORTH, A. M.

A rod 9 feet long is to be divided into three parts, of which A is to have the largest, B the next, and C the smallest. If the two fractures are made at random, A's, B's, and C's expectations will be respectively 66, 30, and 12 inches. But, if one fracture be made at random and the larger portion of the rod be then divided at random, their expectations will be 64, 31, and 13 inches.